

636
✓ DINK
2660

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

REPORT OF PINE BEETLE SURVEYS
OF THE BONANZA AND BLY AREAS
KLAMATH BASIN, OREGON

PROTECTION UNITS OF THE
KLAMATH FOREST PROTECTIVE ASSOCIATION
AND THE FREMONT NATIONAL FOREST

October 1938

By
F. P. Keen
Senior Entomologist
Bureau of Entomology and Plant Quarantine

Forest Insect Laboratory
445 U. S. Court House
Portland, Oregon

REPORT OF PINE BEETLE SURVEYS
of the
BONANZA AND BLY AREAS
KLAMATH BASIN, OREGON

PROTECTION UNITS OF THE
KLAMATH FOREST PROTECTIVE ASSOCIATION
and the
FREMONT NATIONAL FOREST

OCTOBER 1938

By
F. P. Keen
Senior Entomologist
Bureau of Entomology and Plant
Quarantine

Forest Insect Laboratory
445 U. S. Court House
Portland, Oregon

Copies to:-
File.
Dr. Craighead
K. F. P. A.
C. S. Chapman
Forest Service (2)
Miller -

TABLE OF CONTENTS

	<u>Page</u>
Introduction	1
Description of the areas	2
Pine beetle damage	3
Control work	5
Table 1 -- Acreage and timber resources of the Bonanza and Bly Areas	3
Table 2 -- Relation of estimated 1938 loss to 1937 loss on Bonanza and Bly Area plots	4
Table 3 -- Pine beetle damage on sample plots, Bonanza and Bly Areas	6
Table 4 -- Summary of cruising data on sample plots, Bonanza and Bly Areas	8
Table 5 -- Estimated ponderosa pine losses for 1937 on units of the Bonanza Area	9
Table 6 -- Estimated ponderosa pine losses for 1937 on units of the Bly Area	10
Table 7 -- Estimated beetle losses on the Bonanza Area, 1921-1937	11
Table 8 -- Estimated beetle losses on the Bly Area, 1921-1937	12
Chart -- Trend of western pine beetle losses on eight sample plots of Bonanza and Bly Areas, 1921-1937.	
Table 9 -- Control work conducted on Bonanza and Bly Areas, 1933-1937	13
Map -- Western pine beetle survey, Bonanza Area.	
Map -- Western pine beetle survey, Bly Area.	

Introduction

Pine beetle surveys of the Bonanza and Bly Areas have been conducted annually since 1921 to determine the yearly trend of western pine beetle epidemics, the distribution of timber losses, the need for control work, and the results of such work as was undertaken on these areas. The first surveys, from 1921 to 1924, were conducted in connection with the Southern Oregon-Northern California Pine Beetle Control Project; from 1925 to 1930 these were continued by the Bureau of Entomology as a part of their study program; and from 1931 to the present, they have been conducted jointly, as a part of the regional bark beetle surveys, by the Bureau of Entomology and Plant Quarantine, the Forest Service, and the Office of Indian Affairs. The long series of annual loss records for these plots are becoming increasingly valuable in showing the rapid change in forest stand conditions brought about by beetle activity, and how these beetle epidemics have fluctuated in response to climatic changes. Unfortunately, the record cannot be continued for very many more years, as the timberlands are largely in private ownership and logging operations are rapidly removing the old-growth stands in these areas.

The last report summarizing pine beetle conditions on the Bonanza and Bly Areas was made in November 1933. Since then, five years of records have accumulated, so the present report reviews conditions during the period 1934 to 1938 inclusive and summarizes the recent loss record.

During the past five years, the sample plots have been annually recruised, either by men employed by the Bureau of Entomology and Plant Quarantine, or with the help of CCC personnel or field assistants employed by the Forest Service. In 1934, the work was conducted by W. J. Buckhorn with the help of Messrs. Brooks and Simpson, enrollees from the Bly CCC Camp. In 1935, Messrs. Russell Pardue, Ted Emery, and Fred Stone, employed by the Forest Service on regular funds, cruised the plots and ran strips through these areas to determine the general distribution of losses. In 1936 some of the plots in the Bly Area were first cruised from the Bly CCC Camp by CCC student assistants consisting of Messrs. Willard Mannan, G. W. Allison, John A. Carnegie, and Homer F. Matz, working under the supervision of W. J. Buckhorn. Later in the year, plot and strip work was conducted by Messrs. Franklin Brame, Jack Wood, and Claire Gordon, employed by the Forest Service as a part of the general regional bark beetle survey program. In 1937 CCC student assistants with one or two years of

forestry training in college were available for this survey work and a crew of five men consisting of Jack Coskey, Ralph Brinck, Edwin Santee, and Martin Robertson, with Franklin Brame in charge, did intensive work on the sample plots, including a 10 percent green stand cruise and notes on ecological conditions. The 1938 survey was conducted by Messrs. Ashley Poust, George Foley, and Kendall Wood, employed by the Bureau of Entomology and Plant Quarantine. Current losses were tallied and marked and most of the plots were recruised for green stand, using a random 1/4-acre plot method. General estimates for the Bonanza and Bly Areas were made by the writer from plot and observational data.

Description of the Areas

The Bonanza and Bly Areas have been described in previous reports and are shown on the attached maps, so they do not need to be described in detail now.

Bonanza Area.--This area takes in the private timberlands between the south boundary of the Klamath Indian Reservation and the California line in Klamath County, Oregon. It previously constituted a portion of Area 2 of the Southern Oregon-Northern California Pine Beetle Control Project, except that the Bryant Mountain and Stukel Mountain units were not included in that project.

Since 1921 a large part of the western portion of the Area, including the Swan Lake, Hildebrand, and Rocky Canyon units, has been cut over and then burned, and no longer carries sufficient mature ponderosa pine to support beetle infestations. Most of the mature timber now lies in the Goodlow, Royston, and Willow Flat Units, and these latter two units are now being logged.

Bly Area.--This area takes in the timbered slopes of the Sprague River Valley around Bly, Oregon (see attached map). Originally the area constituted the northern portion of Area 3, of the Southern Oregon-Northern California Pine Beetle Control Project. It was on this part of Area 3 that most of the early control work was done.

The timber is largely in private ownership but includes a few sections within the Fremont National Forest. Some logging has been under way during the past 10 years, and a large portion

of the Horsefly and Whitworth Units are now cut over. The main body of timber lies north of Bly in the Meryl Creek and Merritt Creek Units, and on this cutting operations have just recently started.

The timbered area involved and the volume of ponderosa pine estimated as of January 1, 1938, are shown in Table No. 1.

Table No. 1

Acreage and Timber Resources
of the Bonanza and Bly Areas
as of January 1, 1938

<u>Area and Ownership</u>	<u>Timbered Acres</u>	<u>Volume of Pine Mbm</u>	<u>Percent of Stand</u>
<u>BONANZA AREA</u>			
Private	140,000	356,000	64.2
Public Domain	20,000	80,000	14.5
Fremont National Forest	17,000	100,000	18.0
State	<u>3,000</u>	<u>18,000</u>	<u>3.3</u>
Total	180,000	554,000	100.0
<u>BLY AREA</u>			
Private	106,000	1,060,000	58.5
Fremont National Forest	64,000	525,000	28.8
Public Domain	<u>33,000</u>	<u>230,000</u>	<u>12.7</u>
Total	203,000	1,815,000	100.0

Pine Beetle Damage

The Bonanza and Bly Areas have been repeatedly hit by epidemics of the western pine beetle. Following drought conditions which became critical in 1917, a bad outbreak developed in 1918 and 1919 which brought attention to the severe damage which this insect could inflict upon a ponderosa pine forest and resulted in the inauguration of the Southern Oregon-Northern California Pine

Beetle Control Project in 1921. During the period of this project, from 1921 to 1924, losses were held at a comparatively low level. Then, with a continuation of drought conditions, a second epidemic developed, reached a peak in 1926, and declined by 1929. A third epidemic ran its course between 1930 and 1936, reaching its greatest intensity in 1932, with an estimated loss on the two areas of 86,500 M.b.m., or about 3.2 percent of the stand. One section showed a loss of 8.7 percent of the stand for that year, and another section showed a loss of 10.2 percent of the stand for 1931. These three epidemic cycles are shown graphically in the chart accompanying this report. Table No. 3 gives the detailed loss figures for the various sample plots since 1933, and Table No. 4 summarizes these records since 1931. Estimated losses for the areas from 1921 to the present time are shown in Tables No. 7 and No. 8.

In 1937 losses reached a low stage, as shown in Table No. 5 for the Bonanza Area and Table No. 6 for the Bly Area, ranging from 36 to 72 board feet per acre in virgin pine stands and from 3 to 22 board feet per acre on cut-over units. The distribution of these 1937 losses is shown on the attached maps.

The 1938 survey was conducted during August, when less than 50 percent of the total year's loss had developed. By using an estimating factor, based on the date of the cruise, the total 1938 loss was estimated as shown in the following table:

Table No. 2

Relation of Estimated 1938 Loss to 1937 Loss
on Bonanza and Bly Area Plots

Plot	: Site :	Ft. Elev. :	Date of Cruise :	1937 Loss : 1st Cruise:Total:	1938 Loss : Marked:Est.Tot:	Ratio 1938 to '37
Meryl Creek, Sec.20	: 3 :	5600 :	8/31/38 :	25 : 93 :	66 : 132 :	1.42%
Owens	: 3- :	5500 :	8/19/38 :	41 : 90 :	47 : 115 :	1.28
Merritt Creek	: 3- :	5400 :	9/1/38 :	17 : 56 :	28 : 56 :	1.00
Meryl Creek, Sec.11	: 3- :	5300 :	8/26/38 :	16 : 66 :	29 : 63 :	.96
Deming Creek	: 4+ :	5200 :	8/25/38 :	8 : 60 :	21 : 46 :	.77
Royston	: 4+ :	5200 :	8/16/38 :	17 : 60 :	11 : 30 :	.50
Whitworth Creek	: 4 :	5200 :	8/22/38 :	29 : 102 :	24 : 56 :	.55
Goodlow	: 4 :	5100 :	8/10/38 :	11 : 51 :	19 : 57 :	1.12
Total	: :	:	:	164 : 578 :	245 : 555 :	.96
Average per Section	: :	:	:	20.5 : 72.2 :	30.6 : 69.4 :	

One result of the heavy losses of mature timber, which have taken place during the past 20 years and in some cases represent as much as 51 percent of the 1921 stand volume, has been to completely "burn out" the beetle susceptible trees on the lower slopes of the Sprague River Valley on the poorer sites, or "fungal" types, and move the more recent losses back into beetle sites at the higher elevations. At the present time, epidemic losses of more than 100 trees per section are only found on two of the highest check plots in good sites, i.e., Meryl Creek, T 35S, R 15E, Sec 20, and Owens, T 38S, R 15E, Sec 1. On other plots the 1938 loss either is declining, stationary, or at a low ebb. *fringe better*

On the basis of these preliminary estimates, it appears that even though the 1938 summer loss has been greater than that of 1937 that the total loss for the year will be slightly less than that of 1937. The only sections showing an increase are those above 5,400 feet elevation where the site runs to 3- or better.

Control Work

During the past five years, a large amount of control work has been conducted on the Meryl Creek, Merritt Creek, and Deming Creek Units by the Klamath Forest Protective Association. In the fall of 1935 control work was done on the Deming Creek Unit by the Bly CCC Camp. The period of work, number of trees treated, and cost of control are shown in Table No. 9.

As this control was done at a time when the general trend of beetle activity was downward, it is impossible to say how much additional decrease in the losses was due to control. Undoubtedly, the control work helped to break up the larger groups and concentrations of beetle population, and in this way made possible the full effect of the natural decline.

As will be noted by Table No. 2 and the map accompanying this report, there are still epidemic centers of beetle infestation in parts of the Bly Area, particularly in the better sites. Now that the loss trend has reached a low level but shows signs of increasing, there may be need of maintenance control to break up epidemic centers and hold the infestation at a low stage.

Table No. 3

Pine Beetle Damage on Sample Plots
Bonanza and Bly Areas--Klamath Basin
1933 - 1937

Unit and Plot Location	Acres Timbered	Stand Vol. 1931 Mm	Site	Year of Attack	Beetle Losses			Stand	Remarks
					Trees Killed	Volume Killed	Bd.ft. per A.		
<u>BONANZA AREA</u>									
Goodlow Mt. T 39S, R 13E, Sec 5	600	8,846	4	1933	111	77,960	130	.88	This section not disturbed by control work or fire since 1918.
				1934	210	140,060	233	1.59	
				1935	220	106,130	177	1.20	
				1936	89	44,540	74	.50	
				1937	51	31,150	52	.35	
<u>Royston</u>									
T 38S, R 12E, Sec 10	440	5,520	4+	1933	113	83,270	186	1.51	70 acres cut over in 1937.
				1934	104	77,270	175	1.40	
				1935	184	115,330	262	2.09	
				1936	53	40,000	91	.72	
				1937	60	29,930	68	.54	
<u>Willow Flat</u>									
T 37S, R 14E, Sec 20	630	5,893	4	1933	187	146,955	233	2.5	
<u>BLY AREA</u>									
Deming Creek T 36S, R 15E, Sec 25	580	7,876	4+	1933	123	101,940	176	1.29	Treated north tier of 40's in spring of 1934.
				1934	79	58,520	101	.74	
				1935	97	81,530	141	1.03	
				1936	75	49,940	86	.63	
				1937	60	45,170	78	.57	
<u>Deming Creek</u>									
T 36S, R 15E, Sec 8	600	5,117	4-	1933	180	121,325	202	2.38	
				1934	132	80,340	134	1.57	

Table No. 3
(continued)

Unit and Plot Location	Acres Timbered	Stand Vol. 1931 Mbm	Site	Beetle Losses					Remarks
				Year of Attack	Trees Killed	Volume Killed	Bd.ft. per A.	% Stand	
BLV AREA (cont.)									
Owens									
T 38S, R 15E, Sec 1	560	11,187	3-	1933	231	169,855	303	1.52	
				1934	179	164,750	294	1.47	
				1935	118	102,560	183	.92	
				1936	68	51,740	92	.45	
				1937	90	118,610	212	1.06	
Merritt Creek				1933	103	116,790	188	.89	
T 33S, R 14E, Sec 34	620	13,157	3-	1934	144	162,100	261	1.23	Treated in fall, 1935.
				1935	135	162,000	261	1.23	Reduction 62.5%.
				1936	49	60,710	98	.46	
				1937	56	61,870	100	.47	
Meryl Creek				1933	200	159,660	249	1.42	Treated in spring, 1935.
T 35S, R 14E, Sec 11	640	11,252	3-	1934	263	174,450	273	1.55	Reduction 43.7%.
				1935	101	98,480	154	.87	Treated in winter, 1936.
				1936	104	70,080	109	.62	Reduction 14.2%.
				1937	66	60,080	94	.53	
Meryl Creek				1933	279	259,110	405	2.14	Treated in spring, 1935.
T 35S, R 15E, Sec 20	640	12,077	3	1934	184	188,240	294	1.56	Reduction 63.2%.
				1935	103	69,410	108	.57	Treated in winter, 1936.
				1936	110	73,940	115	.61	Increase 22.2%.
				1937	93	90,470	141	.75	
Whitworth Creek				1933	153	76,780	120	1.52	
T 37S, R 16E, Sec 17	640	5,042	4	1934	151	71,380	111	1.41	
				1935	183	83,310	130	1.65	
				1936	110	55,400	86	1.10	
				1937	102	65,980	103	1.31	

Treated in fall, 1935.
Reduction 62.5%.Treated in spring, 1935.
Reduction 43.7%.
Treated in winter, 1936.
Reduction 14.2%.Treated in spring, 1935.
Reduction 63.2%.
Treated in winter, 1936.
Increase 22.2%.

Table No. 4

Summary of Cruising Data on Sample Plots
Bonanza and Bly Areas

Year of Attack	No. of Plots	Timbered Acres Cruised	Trees Killed	Volume Killed	Trees per Section	Bd. Ft. per Acre	% Stand	Volume of Stand in 1931
<u>Totals for All Plots</u>								
1931	14	8,370	4,631	3,462,880	330	419	2.97	116,911,830
1932	14	8,370	6,586	4,892,550	470	585	4.19	116,911,830
1933	10	6,010	1,680	1,313,640	168	218	1.53	85,968,190
1934	9	5,380	1,446	1,117,110	161	208	1.40	80,075,390
1935	8	4,780	1,141	818,750	143	171	1.09	74,958,020
1936	8	4,780	658	446,350	82	93	.60	74,958,020
1937	8	4,780	578	503,260	72	105	.67	74,958,020
<u>Totals for Continuous Plots</u>								
1931	8	4,780	2,742	2,087,910	343	436	2.78	74,958,020
1932	8	4,780	4,292	3,136,670	535	655	4.18	74,958,020
1933	8	4,780	1,313	1,045,360	164	218	1.39	74,958,020
1934	8	4,780	1,314	1,036,770	164	216	1.38	74,958,020
1935	8	4,780	1,141	818,750	143	171	1.09	74,958,020
1936	8	4,780	658	446,350	82	93	.60	74,958,020
1937	8	4,780	578	503,260	72	105	.67	74,958,020

Table No. 5
Estimated Ponderosa Pine Losses for 1937
on Units of the
Bonanza Area

Unit	Forest Acreage		1938 Volume Pine Mbm	Trees	Estimated 1937 Loss		Percent of Stand
	Total	Virgin Pine			Volume Mbm	Bd. ft. Per Acre	
Swan Lake	65,000	12,500	66,000	2,000	620	10	.94
Hildebrand	23,000	2,500	6,000	500	60	3	1.00
Rock Canyon	18,000	14,500	115,000	1,000	640	36	.56
Royston	20,000	18,000	160,000	1,300	950	48	.60
Goodlow	10,000	9,000	70,000	720	480	72	.69
Gerber	3,000	1,000	2,000	70	20	7	1.00
Willow Flat	21,000	8,000	60,000	700	330	16	.55
Bryant Mt.	17,000	12,000	70,000	650	370	22	.53
Stukel Mt.	3,000	2,500	5,000	60	30	10	.60
Total	180,000	80,000	554,000	7,000	3,500	20	.63

Table No. 6

Estimated Ponderosa Pine Losses for 1937
on Units of the
Bly Area

Unit	Forest Acreage		Volume of Pine - 1938 Mbm	Trees	Estimated 1937 Loss		Percent of Stand
	Total	Virgin Pine			Volume Mbm	Bd.Ft. Per Acre	
Merritt Creek	25,000	18,700	275,000	1,200	1,300	52	.47
Meryl Creek	60,000	48,000	630,000	3,100	2,800	47	.45
Deming Creek	27,000	22,300	220,000	1,800	1,300	48	.59
Whitworth Creek	30,000	21,300	295,000	1,250	1,100	37	.37
Owens	26,000	20,000	265,000	1,900	1,600	62	.60
Horsefly	35,000	21,000	130,000	1,750	1,400	40	1.08
Total	203,000	151,300	1,815,000	11,000	9,500	47	.52

Table No. 7

Estimated Beetle Losses on the Bonanza Area

Total Acreage and Pine Stand in 1921

Area - 155,000 Acres.

Volume of Stand - 1,571,000 Mbm.

<u>Year</u>	<u>Trees Killed</u>	<u>Volume Killed</u>	<u>Percent of 1921 Stand</u>
1921	21,010	18,910	1.2
1922	16,140	15,840	1.0
1923	10,120	9,040	.6
1924	16,950	16,940	1.1
1925	38,300	34,220	2.2
1926	55,700	35,630	2.3
1927	54,300	34,050	2.2
1928	42,400	27,920	1.8
1929	22,000	15,940	1.0
1930	24,500	12,100	.8
Total for Decade	301,420	220,590	14.0

Total Acreage and Pine Stand in 1931 *

Area - 175,000 Acres.

Volume of Stand - 800,000 Mbm.

<u>Year</u>	<u>Trees Killed</u>	<u>Volume Killed</u>	<u>Percent of 1931 Stand</u>
1931	28,300	18,500	2.3
1932	33,000	21,500	2.7
1933	16,000	10,000	1.2
1934	20,000	12,000	1.5
1935	20,000	11,000	1.4
1936	9,500	5,000	.6
1937	7,000	3,500	.4
Total for 7 years	133,800	81,500	10.2

* Includes Bryant Mt. and Stukel Mt. Units not previously considered.

Table No. 8

Estimated Beetle Losses on the Bly Area *

Total Acreage and Pine Stand in 1921

Area - 208,000 Acres.

Volume of Stand - 2,500,000 Mbm.

<u>Year</u>	<u>Trees Killed</u>	<u>Volume Killed</u>	<u>Percent of 1921 Stand</u>
1921	18,400	17,420	.7
1922	16,000	15,900	.6
1923	15,800	14,820	.6
1924	21,500	21,830	.9
1925	51,700	46,510	1.8
1926	77,500	60,150	2.4
1927	78,700	60,500	2.4
1928	46,000	38,800	1.5
1929	24,000	22,300	.9
1930	36,200	31,100	1.2
Total for decade	385,800	329,330	13.2

Total Acreage and Pine Stand in 1931

Area - 203,000 Acres.

Volume of Stand - 1,920,000 Mbm.

<u>Year</u>	<u>Trees Killed</u>	<u>Volume Killed</u>	<u>Percent of 1931 Stand</u>
1931	53,000	41,200	2.2
1932	90,000	65,000	3.4
1933	31,000	24,000	1.2
1934	30,000	22,000	1.2
1935	22,000	17,500	.9
1936	12,000	10,000	.5
1937	11,000	9,500	.5
Total for 7 years	250,000	189,200	9.9

* Includes the Merritt Creek, Meryl Creek, Deming Creek, Whitworth Creek, Owens, and Horsefly Units.

Table No. 9

Control Work Conducted on the
Bonanza and Bly Areas
1933---1937

Control Period	Unit	Trees Treated	Volume Treated Mbm	Acres Covered	Cost	Work Done by
Spring, 1934	Deming Creek and Meryl Creek	1,145	1,625	4,440	\$2,472.23	KFPA
Spring, 1935	Meryl Creek	2,913	3,568	15,160	5,888.63	KFPA
Fall, 1935	Merritt Creek and Meryl Creek	1,303	1,703	9,200	2,932.10	KFPA
Fall, 1935	Deming Creek	540	--	9,880	2,451.00	ECW - Forest Service
Spring, 1937	Meryl Creek	606	848	5,680	2,634.95	KFPA

TREND OF WESTERN PINE BEETLE LOSSES

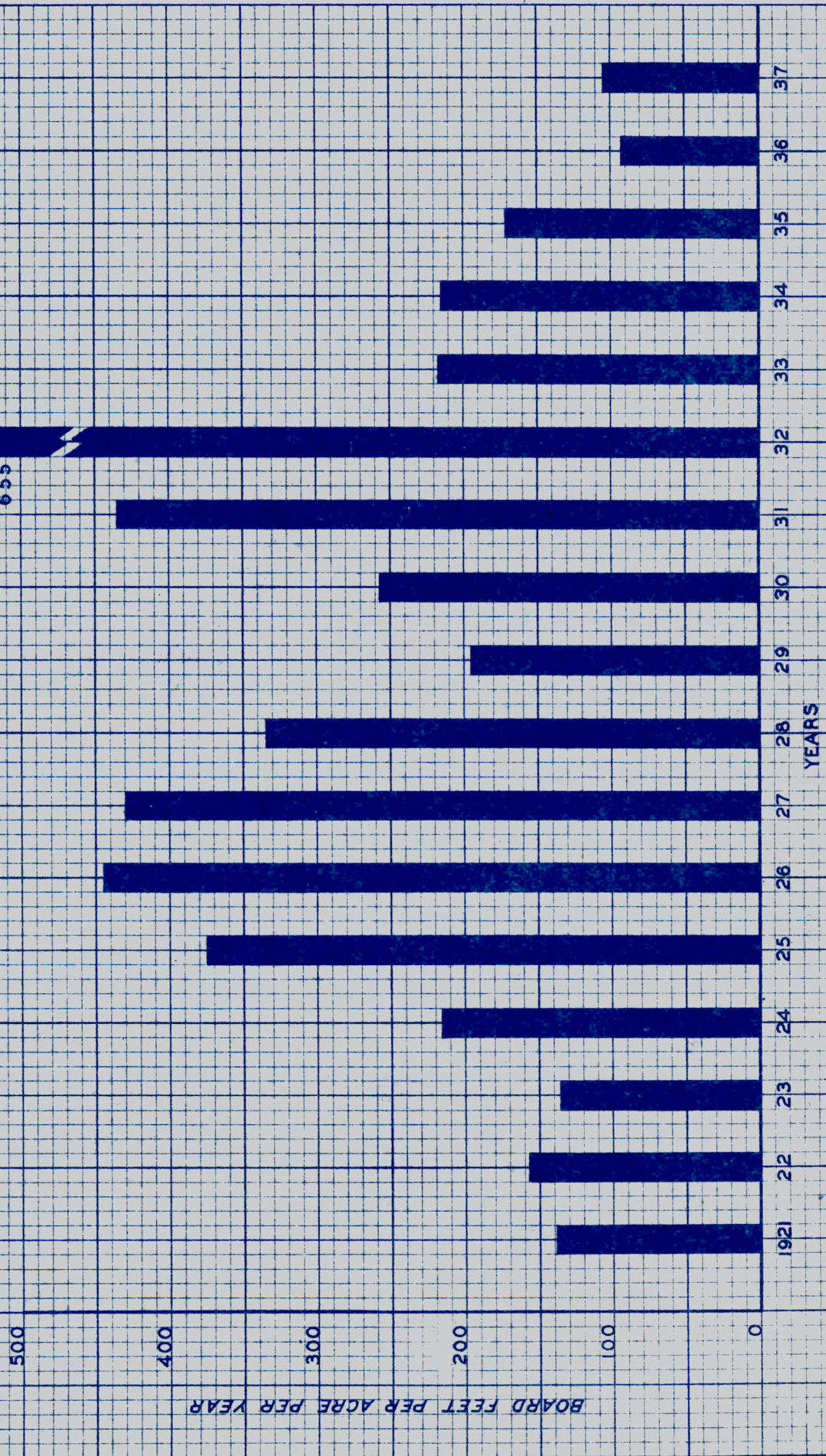
ON

EIGHT SAMPLE PLOTS WITH CONTINUOUS RECORDS FROM 1921 TO 1937

BONANZA AND BLY AREAS — KLAMATH BASIN, OREGON

4780 ACRES — MATURE PONDEROSA PINE — TYPE 20.5

655



1938 PINE BEETLE SURVEY OF PONDEROSA PINE IN OREGON AND WASHINGTON





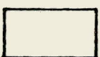
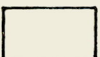
BONANZA AND BLY INFESTATION AREA KLAMATH BASIN, ORE.

LEGEND

AREA BOUNDARIES

UNIT BOUNDARIES

1937 BEETLE LOSS

	0-25 trees per section. Normal infestation. Roughly about 0 to 1/4 of one percent of stand volume.
	25-50 trees per section. Normal infestation. 1/4 to 1/2 of one percent of stand volume.
	50-100 trees per section. Light epidemic infestation. 1/2 to 1 percent of stand volume.
	100-200 trees per section. Moderate epidemic infestation. 1 to 2 percent of stand volume.
	200-400 trees per section. Heavy epidemic infestation. 2 to 4 percent of stand volume.
	Over 400 trees per section. Very heavy epidemic infestation. Over 4 percent of stand volume.

PONDEROSA PINE TYPES

Solid colors. Stands containing more than 50% ponderosa pine and of average or better thrift and vigor. In these stands the western pine beetle is the chief tree-killing agent.

Cross-hatched colors. Stands containing from 20-50% ponderosa pine.





Dotted colors. Ponderosa pine stands of marginal or fringe type. In many of these areas drought as well as insects is an important tree-killing factor.

Brown. Cutover land as of Jan. 1, 1938.

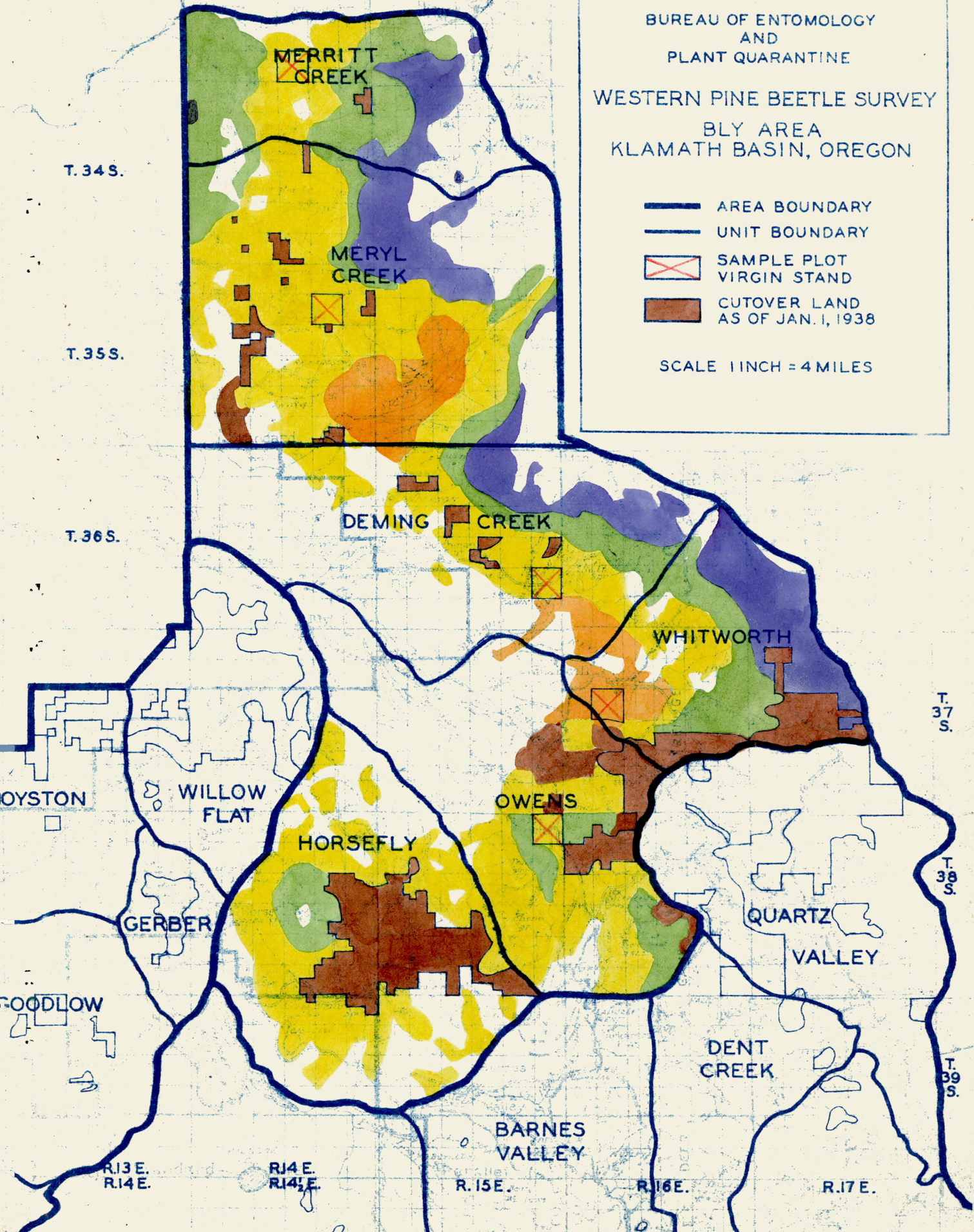
U. S. BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
U. S. FOREST SERVICE
Portland, Oregon

BUREAU OF ENTOMOLOGY
AND
PLANT QUARANTINE

WESTERN PINE BEETLE SURVEY
BLY AREA
KLAMATH BASIN, OREGON

-  AREA BOUNDARY
-  UNIT BOUNDARY
-  SAMPLE PLOT
VIRGIN STAND
-  CUTOVER LAND
AS OF JAN. 1, 1938

SCALE 1 INCH = 4 MILES



T.35S.

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
WESTERN PINE BEETLE SURVEY
BONANZA AREA
KLAMATH BASIN, OREGON

- AREA BOUNDARY
- UNIT BOUNDARY
- ▨ SAMPLE PLOT, VIRGIN STAND
- CUTOVER LAND AS OF JAN. 1, 1938

SCALE 1 INCH=4 MILES

T.37S

T.38S.

T.39S.

T.40S.

T.41S.

R.9E.

R.10E.

R.11E.
R.11E.

R.11E.
R.12E.

R.12E.
R.13E.

R.13E.
R.14E.

R.14E.
R.14E.

R.

SWAN LAKE

HILDEBRAND

ROCK
CANYON

GOODLOW

ROYSTON

WILLOW
FLAT

GERBER

HORSEFLY

DEMING

STUKEL
MT.

BRYANT
MT.

PLATEAU

